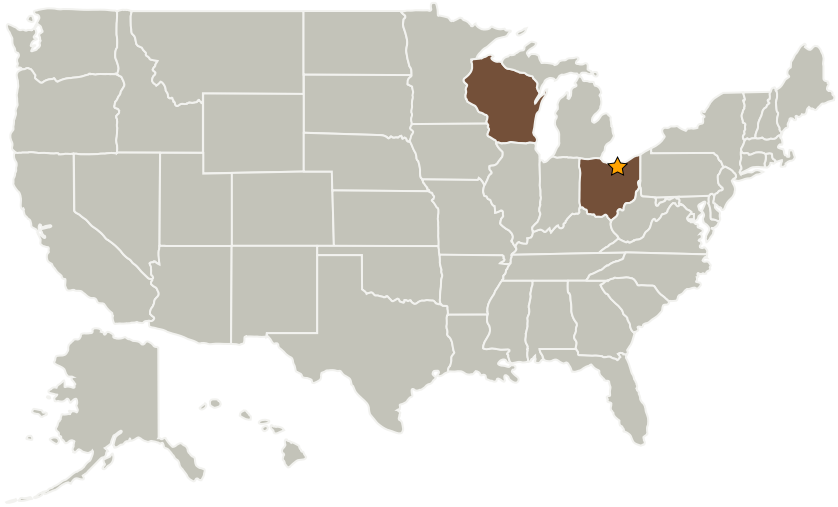
Non-ambipolar Electron Source, Phase I

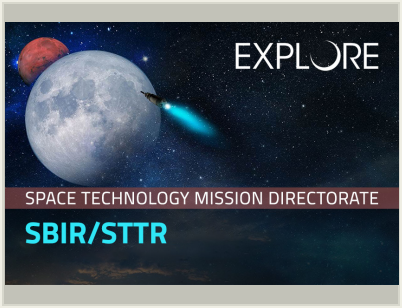
Completed Technology Project (2006 - 2007)

Project Introduction

A device to produce electron beams from magnetized plasma created with rf fields combined with electron extraction by electron sheaths is proposed. The source can provide electrons for neutralizing positive ion beams emerging from ion thrusters or as a generic electron source. With hollow cathode sources currently employed to provide neutralizing electrons, operation is limited in time and/or current density by cathode deterioration. RF electron sources provide an alternative approach that does not consume electrode material. The current from this Non-ambipolar Electron Source (NES) exceeds the current normally extracted from conventional rf plasma sources by a factor of (mi/me)1/2 where mi and me are the ion and electron mass. Ions are lost to a negatively biased conducting cylinder with area Ai chosen to be Ai ≥ (mi/me)1/2 *Ae where Ae is the electron extraction area. Slots in the conducting cylinder allow the cylinder to serve as a Faraday shield to reduce capacitive coupling from the antenna to the plasma. Proposed phase 1 design improvements should result in electron currents comparable to hollow cathode sources with lower neutral gas flow in the inductive discharge phase and higher currents with helicon operation. Phase 2 will develop prototype sources suitable for spacecraft testing.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Phoenix Nuclear Labs	Supporting Organization	Industry	Madison, Wisconsin

Primary U.S. Work Locations	
Ohio	Wisconsin

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes